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The effect of post-learning positive arousal on memory consolidation

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Abstract

Post-learning arousal enhances memory consolidation. The purpose of this study was to investigate the effects of post-learning pleasant arousal on memory consolidation (learning a word list) for emotional and neutral pictures based on gender. 60 undergraduate students (30 men, 30 women) learned a list of 30 words (10 positive, 10 negative, 10 neutral words). Each group watched one of the emotional or neutral films. 30 minutes after watching the film, delayed free recall and recognition tests were being done in order to assess their memory. The results of both tests which were analyzed by t-test were significantly higher in experiment group compare to the control group. These results were true regardless of the nature of films (emotional or neutral). Generally women's performance in memory tests was better than men's. Positive arousal which may occur after watching a movie (as it happens in this article) has deep effect on cognitive performance such as creative problem solving, and facilitates recalling positive or neutral memories and changes deciding strategies.

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Keywords: *arousal, memory consolidation*

1. Introduction

One of the most important characteristic of human's brain is higher cortical function which is more evaluated in comparison with other species. One of these higher cortical functions is memory. Memory is the process of storing the information and experiences and retrieving them in near future. Memory mechanisms are highly under influence of a group of internal and external factors. Emotional states are important internal factors.

Attention, elaboration (Revelle, & Loftus, 1992) rehearsal (Neisser et. al, 1996) and neurohormonal mechanisms in response to a stimulus (McGaugh, 2000) result in a good memory for emotional events. Guy & Cahill (1999) showed that three first factors, attention, elaboration and rehearsal cannot indicate this process accurately but, since activation of the neurohormonal mechanisms especially after a daily event result in memory consolidation, can magnifye that event for us. The process of magnifying an emotional memory is based on memory consolidation which itself is the output of the activity of a complicated group of neurohormonal mechanisms (McGaugh, 2000).

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2. Method

This pseudo experimental study has a pretest- posttest design with control group.

2.1. Participant

A sample of N=60 undergraduate students (30 men and 30 women) attends in this study. They were being selected among 21 to 36 year old Tarbiyat Madares and Tehran universities students. Participants were accidentally divided into experimental and control groups.

2.2. Measures

Word List- 90 words were selected from Persian Linguistic Database (PLDB) (Asi, 1389). Three psychology professors reviewed the list and a pilot study with 50 participants was held and finally 30 words (10 positive, 10 negative, 10 neutral words) were selected for this study. Each participant watched each word for 4 seconds using a computer and repeated it to memorize the word.

Free recall test- All participants were asked to write as many word as they remember from the word list. They had 3 minutes to do this task. This test was being used in 2 stages; first as an immediate free recall test. Participants had to remember the words and write them immediately after presenting the list and before emotional arousal, and second as a delayed free recall test. 30 minutes after manipulation, delayed free recall was being done in order to assess memory consolidation.

Recognition test- This time a list of 75 words (30 words belong to the original list and 45 extra words) was given to the participants and ask them to indicate the words which they have seen before in the original list in 3 minutes. This test was being done in order to assess memory consolidation. Recognition score is the output of this formula:

corrected recognition = (1- error rate) * (hits%)
error = false alarms / distracters (45)
hits% = hits / targets (30)

Arousal - In this study a piece of film (Rottenberg, Ray, Gross, 2007) was used to make participants in experimental group emotionally aroused. Hasani (1387) assessed reliability and validity of this film in Iranian culture. A piece of neutral film (Rottenberg, Ray, Gross, 2007) was used in control group. Five psychology professors watched this film and confirm its neutrality and a pilot study was done on 20 peered subjects who were not included the main sample.

3. Results

Results of t-test for 2 independent groups, investigate the effects of post-learning pleasant arousal on memory consolidation (the scores of delayed free recall and recognition tests) are showed in table 1. The experimental group scored significantly higher on delayed free recall and recognition tests. It means that the pleasant arousal after learning enhances memory consolidation.

Table 1. Results of t-test for comparing experimental and control groups (df = 58)

		M	SD	t	p
delayed free recall tests	1	12.70	4.23	3.31	0.002
	2	9.46	3.25		
recognition tests	1	70.04	12.48	3.57	0.001
	2	57.82	13.98		

1 = experimental group 2= control group

4. Discussion

The purpose of this study was to investigate the effects of post-learning pleasant arousal on memory consolidation. The results indicate that a pleasant arousal after learning enhances memory consolidation.

Nielson and Bryant (2005) created emotional arousal after learning, using intrinsic and extrinsic rewards and assessed their effect on memory consolidation. They found that extrinsic rewards (pay 1$) enhance memory consolidation but intrinsic rewards (verbal admiration) don't have any effect on the process.

In fact, positive affect and arousal due to receiving a gift or watching a pleasant film, improves cognitive performance such as creative problem solving (Estrada, Young & Isen, 1994) and recalling positive memories (Nasby & Yando, 1982). Pleasant experiences are related to Dopaminargic system (McGaugh, 2004) so dopamine release during pleasant experiences will affect learning and memory.

Assessing neurohormonal mechanisms activated in response to arousing stimuli, indicates that releasing epinephrine and norepinephrine while experiencing a pleasant event activates central or peripheral receptors and brain stem and according to inverted-U model enhances memory (McGaugh, 2000).

So watching a positive film after learning affects memory and enhances delayed recognition for emotional or non emotional memories. Since word list and arousal source were not related to each other and manipulation was given after learning, emotional arousal did not have any effect on attention and coding and just affected memory consolidation.

Limitations such as the sample type (volunteer participants), assessing method (not having a physiological assessment) and ignorance of mediator variables call for further works. All these limitations cannot deny the efficiency of the results which emphasize on the effect of emotional arousal on memory consolidation. Teachers, students and parents can rely on these findings and try to improve their learning to guarantee their success

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